

### **REMARKS**

This is intended as a full and complete response to the Office Action dated April 23, 2009, having a shortened statutory period for response set to expire on July 23, 2009. Claims 26-50 were pending in the application and are shown above. Claims 43, 49 and 50 were withdrawn by the Examiner. Claims 26-42 and 44-48 are rejected by the Examiner. Applicant cancels claims 26-50 without prejudice. Applicant submits new claims 51-67 for consideration by the Examiner. Reconsideration of the rejected claims is requested for reasons presented below.

A certified English translation of priority document Germany 10315846.4 is being prepared and will be submitted separately.

In the specification, a new abstract has been presented to clarify the invention. The section header "Brief Description of the Drawings" and new paragraphs are submitted for inclusion in the specification after the Title on Page 1, lines 3-5, of the specification. Support for the figures is founded from page 17, line 20, to page 19, line 25, of the English translation of the specification.

Applicant presents new claims 51-67 for consideration by the Examiner. Applicant presents the following arguments in view of the pending references as applied to the subject-matter as recited in new claims 51-67. The pending references include *Dai et al.* (Adv. Mater. 13(7):1339-42; 2001), referred to as *Dai I*; *Dai et al.* (Macromol. Rapid Commun. 22(11): 756-762; 2001), referred to as *Dai II*; *Kaschak et al.* J. Am. Chem. Soc. 118:4222-4223, (reference [9] in *Dai II*); *Dai et al.* (Langmuir 18:4553-55; 2002) referred to as *Dai III*, and *Daehne et al.* (J. Am. Chem. Soc. 123: 5431-5436; 2001), referred to as *Daehne*.

None of the references listed above describes or suggests capsules as described in new claim 51. Particularly, none of the cited references describes covalently linking a dye to a sensitive material in such a sufficient concentration to achieve self-quenching. Furthermore, none of the cited references suggest using material to which a dye is covalently linked in sufficient concentration as a sensitive material. The aspect that self-quenching and the variation due to the swelling (increasing volume) or shrinking (decreasing volume) of the sensitive material are employed is not suggested by any of the

cited references. Further arguments regarding the individual references are detailed below.

### ***Election/Restriction***

The Applicant acknowledges the Examiner deeming the restriction requirement proper and final. Applicant has cancelled claims 26-50 without prejudice and believes the prior restriction requirement is now moot. Applicant submits that new dependent claim 58 correspond to prior dependent claim 43. Applicant respectfully requests that a new restriction requirement be issued as necessary with regards to new claims 51-67.

### ***Claim Rejection – 35 USC § 112***

Claims 31 and 39 stand rejected under 35 USC § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully responds to the rejection.

Claim 31 has been cancelled without prejudice by the applicant, and none of the new claims 51-67 have the subject-matter as recited in Claim 31.

Claim 39 has been cancelled without prejudice by the applicant. New claim 54 that recites the subject-matter of claim 39 has been submitted by the Applicant. Applicant respectfully submits that the ratio, *i.e.*, the proportion, of the value of the mass of sensitive material to the value of the mass of the dye satisfies the given expression as being smaller than the ratio of 500 to 1 as in the mathematical expression:  $m_s/m_d < 500:1$  where,  $m_s$  is the mass of the sensitive material and  $m_d$  is the mass of the dye. See also page 5, line 9-11 of the description. New claim 54 is not presented to distinguish a reference, thus, the claims are entitled to a full range of equivalents if not previously amended to distinguish a reference.

Withdrawal of the 35 USC § 112 rejection is respectfully requested.

***Claim Rejection – 35 USC § 102***

Claims 26-35, 38, 40-42 and 45-48 are rejected under 35 USC § 102(b) as being anticipated by *Dai et al.* (Adv. Mater. 13(7):1339-42; 2001), referred to as *Dai I*. The Examiner asserts that the reference discloses all of the limitations of claims 26-35, 38, 40-42 and 45-48. Applicant respectfully responds to the rejection.

Claims 26-35, 38, 40-42 and 45-48 have been cancelled without prejudice by the Applicant.

Applicant presents new claims 51-67 for consideration by the Examiner. Applicant presents the following argument in view of *Dai I* as applied to the subject-matter as recited in new claims 51-67.

*Dai I* describes the use of dyes as building blocks in LbL multilayer capsules and proposes a combination of adsorption of low molecular dye molecules from non-aqueous solvents and adsorption of a suitable macromolecule from aqueous solutions to build capsules. The dye in *Dai I* is adsorbed as a separate layer and is not covalently linked, either to a sensitive material or to adjacent polyelectrolyte layers. Furthermore, the alternating adsorption of dyes and polyelectrolytes does not create a covalent link between these entities. In fact, there is only an electrostatic interaction between adjacent layers in the LbL assembly.

Moreover, since *Dai I* uses the fluorescent dyes merely to quantify the layer adsorption in a convenient way (*Dai I*, page 1340, left column, line 23-25), no high dye concentration resulting in self-quenching is employed by *Dai I* since this would prevent observation of the layer assembly. Particularly, confocal laser scanning fluorescence microscopy (CLSM) could not have been applied to visualize the resulting capsules if self-quenching occurs.

Since the dye is used to form a separate layer in an alternating polyelectrolyte-dye multilayer stack, no suggestion is given to employ a dye which labels a polyelectrolyte layer and which is covalently linked to a sensitive material in sufficient (high) concentration as in the present application.

The dyes used in *Dai I* are environmentally sensitive by themselves, e.g., IR being sensitive for infrared irradiation (*Dai I*, page 1342, right column, lines 1-5) and the cyanine dyes - as known to the skilled person - being sensitive towards pH. Therefore, *Dai I* neither links covalently any dye to a sensitive material nor does he suggest any link to a sensitive material. Even the vaguely mentioned possible application of composite capsules as tunable color filters or pH-sensitive coatings (*Dai I*, page 1342, left column, last paragraph) could not lead a skilled person to dyes which are covalently linked to a sensitive material in sufficient (high) concentration because *Dai I* uses dyes which are already sensitive to environmental changes so that no additional sensitive materials would be required.

Also no sensing material capable of shrinking or swelling to which a dye is covalently linked as disclosed in *Dai I*. Furthermore, this functional feature is not a "*recitation of intended use*" as alleged by the Examiner but an intrinsic feature of the sensitive material.

With respect to the formation of aggregates, please note that *Dai I* describes formation of aggregates only upon adsorption onto polyelectrolytes (PSS/IR and CS/IR - Cf. *Dai I*, page 1341, left column, second paragraph); whereas new claim 51 defines that the aggregates are formed by the dye itself, i.e., by the dye molecules.

Thus, *Dai I* does not disclose a sensitive material to which a dye is covalently linked, wherein the sensitive material increases in volume or decreases in volume depending on environmental conditions. Thus, *Dai I* does not disclose a sufficient concentration of the dye so that self-quenching occurs, wherein the extent of self-quenching varies with the increases in volume or decreases in volume of the sensitive material to which the dye is covalently linked.

Therefore, *Dai I* does not teach, show, suggest a capsule comprising a diameter of less than 100  $\mu\text{m}$  and an envelope comprising at least three polyelectrolyte layers and containing only one dye with at least one of the at least three polyelectrolyte layers being labeled with only one dye, and the dye is covalently linked to a sensitive material with the sensitive material adapted to react to changed environmental conditions by an increase in volume or a decrease in volume, wherein the dye has a sufficient concentration for the dye to form dimers, aggregates or excimers, and wherein the dimers, aggregates or excimers

self-quench fluorescence or form a new emission band, as recited in claim 51 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 26-30, 33-37, 40-42 and 44-48 are rejected under 35 USC § 102(b) as being anticipated by *Dai et al.* (Macromol. Rapid Commun. 22(11): 756-762; 2001), referred to as *Dai II*. The Examiner asserts that the reference discloses all of the limitations of claims 26-30, 33-37, 40-42 and 44-48. Applicant respectfully responds to the rejection.

Claims 26-30, 33-37, 40-42 and 44-48 have been cancelled without prejudice by the Applicant.

Applicant presents new claims 51-67 for consideration by the Examiner. Applicant presents the following argument in view of *Dai II* as applied to the subject-matter as recited in new claims 51-67.

*Dai II* teaches dye-labeled polyelectrolytes to merely visualize LbL capsules as fluorescent layers on microcrystalline surfaces (*Dai II*, p. 757, right column, paragraph 5, line 15-18). However, no sensitive material to which a dye is covalently linked in such a sufficient (high) concentration that the dye forms, with itself, dimers, aggregates or excimers, which lead to self-quenching of the fluorescence or to the formation of a new emission band is described. In view of *Dai II*'s goal to observe easily the capsules, no self-quenching is desired and therefore naturally avoided by *Dai II*. A skilled person would therefore also not consider a sufficient (high) dye concentration which leads to self-quenching.

The swelling mentioned in *Dai II* is caused by osmotic pressure (*Dai II*, p. 761, right column, paragraph 2, line 9-11) and relates to the capsule volume, not to a sensitive material covalently coupled to a dye. No hints are given, that the capsule material itself would swell or shrink in response to external factors reproducibly and hence could be used as a sensing material.

Accordingly, we traverse the conclusion of the Examiner, that *Dai II* suggests sensitive materials. *Dai II* does not teach shrinking or swelling of the rhodamine B-labeled PAH or the FITe-labeled PAH in reaction to changed environmental conditions and therefore gives no hints regarding these properties.

Based on the arguments provided above new claim 51 is new and inventive over *Dai II* and its combination with *Dai I*, because they neither disclose, teach or suggest polyelectrolyte layers according to new claim 51, which are labeled with at least one dye, which is covalently linked, at sufficient (high) concentration, to a sensitive material, with the concentration of the dye being sufficient (high) that the dye forms, with itself, dimers, aggregates or excimers.

Therefore, *Dai II* does not teach, show, suggest a capsule comprising a diameter of less than 100  $\mu\text{m}$  and an envelope comprising at least three polyelectrolyte layers and containing only one dye with at least one of the at least three polyelectrolyte layers being labeled with only one dye, and the dye is covalently linked to a sensitive material with the sensitive material adapted to react to changed environmental conditions by an increase in volume or a decrease in volume, wherein the dye has a sufficient concentration for the dye to form dimers, aggregates or excimers, and wherein the dimers, aggregates or excimers self-quench fluorescence or form a new emission band, as recited in claim 51 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Further, the Examiner refers to *Daehne et al.* (J. Am. Chem. Soc. 123: 5431-5436; 2001), referred to as *Daehne*, without being part of the rejection with regard to claims 29, 30, and 35.

The Examiner cites the *Daehne* reference with respect to the alleged shrinking capabilities of PAH/PSS capsules. However, this relates to the capsules and not to a sensitive material to which a dye is covalently linked. From the fact the PAH/PSS capsules can shrink, a skilled person cannot derive that a sensitive material itself shrinks or swells. Furthermore, their use as sensing element was not suggested. Also, no volume changes of a sensitive material as in new claim 51 are described.

In addition, *Daehne* describes swelling or shrinking of the capsules as a result of osmotic changes. Since osmotic pressure can built-up only behind a semi permeable barrier, capsule volume changes in *Daehne* are depending on the permeability of the capsule wall and its modification by adsorbed or intertwined PSS (*Daehne*, page 5435, Fig. 5 and page 5433, second paragraph - page 5434, left column, line 6). In contrast to that, volume changes of instant application are related to, and induced by, the sensitive material

itself. The sensitive material, according to new claim 52 is a material which either swells or shrinks, with its volume thereby being altered, when its environmental conditions change. Since swelling or shrinking of the wall material in *Daehne* has not been considered even theoretically, and volume changes have been related to osmotic pressure alone, capsules of new claim 51 are new and inventive over *Daehne*.

Also, the dyes in *Daehne* were adsorbed at the non-modified initial capsules (*Daehne*, p. 5434, left column, line 9-10). Since adsorption does not create a covalent link. no covalent link between a dye and a sensitive material is disclosed by *Daehne*. None of the dyes in *Daehne*, i.e. the positively charged rhodamine 6G and the negatively charged fluorescein is covalently linked to a sensitive material. If the dyes are covalently linked, it is impossible to study their diffusion through or their exclusion by the wall as observed for rhodamine and fluorescein, respectively. *Daehne* therefore does not disclose, teach or suggest capsules according to amended claim 51 of the instant application.

The same conclusion has to be drawn for the combination of all cited documents, since, taken together, they do not disclose, teach or suggest capsules according to amended claim 51 and as shown, would rather guide the skilled person away from the polyelectrolyte capsules with dyes, covalently linked to a sensitive material in sufficiently high concentration.

Therefore, the capsule of the amended claim 51 is inventive as well.

Further, the Examiner refers to *Kaschak et al.* J. Am. Chem. Soc. 118:4222-4223, (reference [9] in *Dai II*), without being part of the rejection with regard to claims 35-37.

*Kaschak* teaches tagging of the polycation PAH with two different dyes fluorescein and rhodamine. Their molecular donor-acceptor interaction (FRET) has been used to study the structure of intermittent ZrP/PAH "spacer" bilayers (*Kaschak*, p. 4223, left column, line 3-6). Different thereto, claim 51 includes the feature that a polyelectrolyte layer is labeled with only one dye, which is covalently linked to a sensitive material, with the concentration of the dye being so high that the dye forms, with itself, dimers, aggregates or excimers. Furthermore, *Kaschak* does not disclose capsules.

*Kaschak* therefore describes a FRET system which employs two different fluorescent dyes which exhibit a radiationless transition from the donor dye to the acceptor

dye. FRET systems require two different dyes and are therefore completely different to the system defined by new claim 51. Claim 51 refers to only one dye which is covalently linked in high concentration to cause self-quenching. Self-quenching prevents the radiationless transition of the FRET system which would render a FRET system inoperable. Therefore, a skilled person, when designing a FRET system, would not chose a concentration of the dye so high that the dye forms dimers, aggregates or excimers with itself, which lead to self-quenching. Consequently, *Kaschak* teaches away from the capsules of new claim 51. The mere speculation on polymer coiling in reaction to ionic strength together with the employed FRET principle would not suggest a sensing material as described by new claim 51; its discussion is therefore hindsight.

Therefore, a capsule according to new claim 51 is new and inventive over *Kaschak* alone and the combination of *Kaschak* with *Dai I* and/or *Dai II*, because they neither disclose, teach or suggest polyelectrolyte capsules, with polyelectrolyte layers being labeled with only one dye, which is covalently linked to a sensitive material, with the concentration of the dye being so high that the dye forms, with itself, dimmers, aggregates or excimers with itself, according to the new claim 51.

Withdrawal of the rejection is respectfully requested.

Claims 26, 27, 29-34, 36-42 and 44-48 are rejected under 35 USC § 102(b) as being anticipated by *Dai et al.* (Langmuir 18:4553-55; 2002) referred to as *Dai III*.

The Examiner asserts that the reference discloses all of the limitations of claims 26, 27, 29-34, 36-42 and 44-48. Applicant respectfully responds to the rejection.

Claims 26, 27, 29-34, 36-42 and 44-48 have been cancelled without prejudice by the Applicant.

Applicant presents new claims 51-67 for consideration by the Examiner. Applicant presents to following argument in view of *Dai III* as applied to the subject-matter as recited in new claims 51-67.

*Dai III* discloses teaches non-covalently linked multichromophoric assemblies in the walls of polyelectrolyte capsules (Cf. *Dai III*, page 4553, right column, line 13-17). Different thereto, new claim 51 calls for capsules having a polyelectrolyte layer which is labeled with only one dye, which is covalently linked to a sensitive material, with the concentration of



the dye being so high that the dye forms, with itself, dimmers, aggregates or excimers. Particularly, *Dai III* does not describe a dye which is covalently linked to a sensitive material.

*Dai III*, similar to *Kaschak*, describes FRET systems. For the reasons set-forth in respect to *Kaschak*, *Dai III* requires, and describes, two different dyes for forming FRET systems. Furthermore, the dyes of *Dai III* need to have a low concentration to avoid self-quenching since self-quenching would render the FRET system inoperable.

Therefore, a capsule according to new claim 51 is new over *Dai III*. Combinations of *Dai I* - *Dai III* and *Kaschak* are not suggesting capsules with a dye, covalently linked to a sensitive material in sufficient high concentration to cause self-quenching. In fact, the objective of *Dai I*, *Dai II*, *Dai III* and *Kaschak* would guide the skilled person away from capsules, according to new claim 51, since FRET requires two different dyes and free interaction of the dye molecules with each other, which would be disturbed by any self-quenching of the dye molecules.

Therefore, *Dai III* does not teach, show, suggest a capsule comprising a diameter of less than 100  $\mu\text{m}$  and an envelope comprising at least three polyelectrolyte layers and containing only one dye with at least one of the at least three polyelectrolyte layers being labeled with only one dye, and the dye is covalently linked to a sensitive material with the sensitive material adapted to react to changed environmental conditions by an increase in volume or a decrease in volume, wherein the dye has a sufficient concentration for the dye to form dimers, aggregates or excimers, and wherein the dimers, aggregates or excimers self-quench fluorescence or form a new emission band, as recited in claim 51 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Further, the Examiner refers to *Daehne et al.* (J. Am. Chem. Soc. 123: 5431-5436; 2001), referred to as *Daehne*, without being part of the rejection with regard to claims 29, 30, 36, and 37. Withdrawal of the rejection is respectfully requested.

***Claim Rejection – 35 USC § 103***

Claims 26-42 and 44-48 are rejected under 35 USC § 103(a) as being unpatentable over *Dai et al.* (Macromol. Rapid Commun. 22(11): 756-762; 2001), referred to as *Dai II*, in view of *Dai et al.* (Langmuir 18:4553-55; 2002) referred to as *Dai III*. The Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to label the appropriate layers of a capsule with fluorescent dyes and to use the appropriate concentration of dyes; to label various layers of nanocapsules for use in FRET analysis; to substitute one type of dye labels layer for the other; to use fluorescent dyes with various concentrations; and to have a reasonable expectation of success of achieving such modifications. Applicant respectfully responds to the rejection.

Claims 26, 27, 29-34, 36-42 and 44-48 have been cancelled without prejudice by the Applicant.

Applicant presents new claims 51-67 for consideration by the Examiner. Applicant presents the following argument in view of *Dai II* and *Dai III* as applied to the subject-matter as recited in new claims 51-67.

*Dai II* and *Dai III* are described above.

*Dai II* and *Dai III*, alone or in combination, do not teach, show, suggest, or otherwise make obvious a capsule comprising a diameter of less than 100  $\mu\text{m}$  and an envelope comprising at least three polyelectrolyte layers and containing only one dye with at least one of the at least three polyelectrolyte layers being labeled with only one dye, and the dye is covalently linked to a sensitive material with the sensitive material adapted to react to changed environmental conditions by an increase in volume or a decrease in volume, wherein the dye has a sufficient concentration for the dye to form dimers, aggregates or excimers, and wherein the dimers, aggregates or excimers self-quench fluorescence or form a new emission band, as recited in claim 51 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

***Double Patenting***

Claims 26 and 28 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 9-12 of co-pending Application No. 11/717, 989. Applicant respectfully responds to the rejection.

Applicant acknowledges the provisionally rejected on the ground of non-statutory obviousness-type double patenting and will submit a terminal disclaimer as necessary once the double-patenting rejection is no longer provisional.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicant's disclosure than the primary references cited in the office action. Therefore, Applicant believes that a detailed discussion of the secondary references is not necessary for a full and complete response to this Office Action.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

By 

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